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ABSTRACT

A case study investigated the use of telematics technology in the delivery of learning programs from a rural high school in Western Australia to four receiver schools. Telematics is an audiographic computer system that simultaneously links a teacher to classrooms in one to five other schools. The program was introduced in 1991 to widen curriculum choices for rural, isolated students. Interviews with administrators, teachers, and program coordinators at the delivery and receiving schools focused on six key program factors: accessibility, ease of use, reliability, functional application, organization, and lesson delivery. The study concluded that sharing of resources within a small cluster of schools has enabled schools to increase curriculum choices, allowed staff and students to become familiar with computer-based technology, encouraged and motivated staff to develop innovative educational practices, developed cooperation between schools in the network, increased retention of students in postcompulsory education, and increased opportunities for girls to develop technological competencies. It was also found that the location of the telematics equipment in the school was significant to program success, and that staff wanted existing facilities and equipment to be upgraded to improve lesson delivery. Staff also expressed concerns related to the level of program support and commitment demonstrated by the Ministry of Education, and the provision of a capable and reliable telephone service essential for program implementation. Contains 24 references. (LP)

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THE DEVELOPMENT OF TELEMATICS IN A RURAL DISTRICT IN WESTERN AUSTRALIA

J. Bowden – Australia

ABSTRACT

The Telematics program in Western Australia was introduced in 1991, and was designed to cater for a range of learning styles, maximisation of choice, and the provision of successful curriculum experiences for isolated students. Through the auspices of this program, the use of appropriate technology to widen access to the curriculum has facilitated cross-sector collaboration in the effective application of teaching and learning in a distance education environment. The objective of this research was to investigate the use of the Telematics technology in the delivery of learning programs from one small rural district high school.

A case study approach was selected as the data would reflect individual experiences both at the delivery and the receiving schools. To establish a base from which to make judgments and assertions, a series of six key factors were elicited. These presented a number of aspects that contributed to a comprehensive picture regarding the development, implementation and ongoing maintenance of the Telematics program.

The study concluded that the sharing of such resources within a small cluster of schools, has enabled them to increase their flexibility in terms of curriculum choices, exploration and familiarisation of the computer based technology, encouragement and motivation for the staff to develop innovative practices, co-operation between the various schools in the network, retention of students in post-compulsory education and opportunities for girls to develop technological competencies.

RC020396

BACKGROUND

There are a number of economic factors, both external and internal that are occurring simultaneously in Australia to force a re-examination of workforce and training needs. Public and private industries as well as government agencies are seeking to develop skilled and adaptable workers. The key trends within the education and training sectors have been therefore, to focus on improvements in organisational

restructuring, improvements in student performance and improvements in workforce productivity.

The physical size and vastness of Western Australia, and the relatively small population with its concentration around the coast, creates some problems of economies of scale for the delivery of education and training to remote areas. Access and equity for all students, has in recent years formed part of the state educational agenda designed to meet the needs of a small number of Australians who, either by choice, or because of necessity must live in very isolated conditions.

During the 1990s, the growing level of interest in Western Australia in network technology (communications technology), which links classrooms, teachers and individual students to a range of external sources, has served to open up new avenues of distance learning. The use of technology has provided a means for accessing information for those students who are disadvantaged by such factors as geographical isolation. Smith, Fyffe & Lyons (1993), describe distance education as a "mutating virus, in that schools are now required to provide by electronic and other telecommunications devices, a range of courses for a widely scattered and increasingly diverse population of students. In the past few years, distance educators have been undertaking trials using communications in regional areas. The diversity of these initiatives has stimulated a resurgent interest in distance learning by state education systems, an interest that has been accompanied by some rapid developments in the technologies to support such programs.

The use of appropriate technology to widen access to the curriculum and to enable cross – sector collaboration in the effective application of teaching and learning is being applied to rural and remote schools and to the distance education environment in Western Australia. The introduction of Telematics has however resulted in a comprehensive project, with fifty schools participating in staff training and development programs for delivery of the curriculum to rural and remote schools.

There are approximately 91,000 non-metropolitan based students in Western Australia who attend rural schools or receive correspondence and/or radio delivered lessons. Until quite recently, supplementary tutorial support for distance learning had been restricted to the telephone and a few sporadic face to face visits. Over the past four years, schools in Western Australia, including the Distance Education Centre have been very proactive in introducing modern communication technologies to enhance their traditional classroom methods of instruction. The benefits have included greater learner control, more rapid response to the teaching and learning process and a clear focus on the strategies to support individualised learning. In addition these technologies can provide access to information services for research and inquiry from any remote location computer, modem and a telephone connection.

Telematics

Telematics (a generic term to encompass all electronic "real time" communications), is an audiographic system that is being used to provide an extended classroom by linking the teacher to between one to five school sites simultaneously.

In 1992, a group of schools in the Moora District in Western Australia formed a local schools network to trial the Telematics system and to share the available teaching expertise within the district. This has provided tangible benefits for students in terms of facilitating access to a broader range of curriculum areas such as Languages other than English (LOTE). For the past eighteen months all schools in the network have participated in a collaborative program to trial the use of the Telematics equipment for curriculum delivery as well as for professional development purposes. Aspects of this program have subsequently been taken up by other districts/projects throughout Western Australia.

The use of telematics involves the sharing of resources within a cluster of rural schools, and has the potential to increase their economic viability and to create a positive image of the school within their local community. Other benefits to schools choosing to explore the technology, include increased curriculum choice, exploration and familiarisation with computer technology, encouragement and motivation for the staff to develop innovative practices, cooperation between schools, retention of students in post-compulsory education and opportunities for girls to develop technological competencies.

With the implementation of the Telematics program in Western Australia, there have been some clearly identifiable problems. The lack of funding both for the establishment of the equipment and for the recurrent costs associated with a program that has its grass roots embedded in a local school setting is a major impediment to its success. Likewise the need for staff training, technological and curriculum support, and a commitment towards developing and improving instructional design skills for teachers has had an impact on the growth of such systems. Inherent in planning local school networks, there is the additional factor associated with the collaborative nature of the program, as administrators by necessity have to reach consensus regarding the timetabling aspects across the network, to facilitate the simultaneous delivery of the curriculum.

OBJECTIVE OF THE CASE STUDY

To investigate the use of Telematics technology in the delivery of learning programs from Wyalkatchem District High School from the perspective of the educator participants.

METHODOLOGY

Background to the Study

As the Telematics programs that are operating in schools at present have not yet been fully developed, and the Education Department of Western Australia is seeking refinements to the proposed implementation of the technologies on a widespread basis, it seemed appropriate that a case study approach be adopted to investigate the Telematics program as it operates at one District High School and its receiver schools. The Moora District was one of the earliest districts to embark upon the use of communications technologies in 1991 when the District Superintendent proposed the installation of an audiographic system to meet the growing demands for enhancing the curriculum. Despite a difficult introduction through what was perceived as a 'top- down' model, Wyalkatchem District High School assumed the leading role in the district.

Research Methods

The case study approach seemed to be the most appropriate research model which would give rise to the collection of rich data based on individual experiences both at the delivery and the receiving sites. To establish a base from which to make judgments and assertions, a series of six key factors were elicited. Each of the key factors contained a number of aspects that could provide a comprehensive picture regarding the development, inplementation and ongoing maintenance of the Telematics program. The key factors were as follows:

- Accessibility
- Ease of Use
- Reliability
- Functional Application
- Organisation
- Lesson Delivery

Three types of data sources were used as shown in the table below.

TABLE OF DATA SOURCES

DATA SOURCE	PERSONNEL	NO.	POSITION IN SCHOOL
Interviews	Administrators	2	Principal
	Teachers	4	Deputy Principal
	Program Co-ordinators	4	Teachers
Observation	Teachers	3	Upper School
			Lower School

Biographical/ Historical Data	Administrators	1	Principals
	Teachers	1	Teachers
	Others	3	Support Staff

RESULTS AND INTERPRETATION

The data collected was grouped into issues and patterns of events, and a number of trends and attitudes analysed.

From this data a number of assertions were made.

Assertion 1

Telematics can be used for all subjects and by any teacher regardless of background experience in computers and level of technological confidence.

Classes in Human Biology, English and Mathematics (Upper school) were taught by three different teachers at Wyalkatchem District High School and operate side by side with Italian classes being taught to students in Years 4-8 by the Home Economics teacher. During certain class periods, an upper school class is taught at the same time as the Italian class, in the same room using a different set of equipment.

Teacher Background

Staff at Wyalkatchem District High School were identified for their teaching expertise by the Principal and the Program Coordinator. None of them had any significant background in using computers, and none of them had any experience in using communications software or the Telematics program. As a direct result of teaching on the Telematics program, all teachers indicated that during the year, they felt that they had gained confidence in using the system for its designated purpose, and had developed strategies to overcome technical and pedagogical problems.

Assertion 2

The location of the Telematics equipment in a school, is critical to the success of the program.

During 1992, the Telematics equipment was installed at Wyalkatchem District High School and at four receiving sites in the Moora District. Many of these schools experienced some difficulties with the initial decision as to where to locate the Telematics equipment.

Wyalkatchem District High School

At Wyalkatchem the placement of the system in the library by the Deputy Principal created some problems and resulted in a re-location and the purchase of a further set of equipment by the school in order to accommodate the growing demands within the district. In this regard the Deputy Principal had some background in computers and was technically competent in establishing the system within the school.

Due to the fixed nature of telephone connections, the relocation of the Telematics equipment at Wyalkatchem resulted in the designation of a special room for the Telematics equipment. This room was located in the middle of the school midway between the primary and secondary sections. Both sets of equipment were housed in this room and placed about ten feet apart so that each had access to the overhead projector. There were no sound panels separating the two sets of equipment and on several occasions both sets were used simultaneously. A timetable indicating the program for each subject was displayed prominently on the wall.

The Telematics room also housed a resource collection of books and other materials which were at various times collected by groups of students who needed them for mainstream classes.

Telematics Location at Receiving Sites

At the receiving sites, the equipment was located variously in the library, a special computer room off the library and even in the staff room. The majority of these schools were very small primary schools, and so well established that the incursion of additional space for the Telematics equipment posed a real problem. In the main the location was selected as it was the only available space although several schools indicated that priority was given for maximising the usage by students.

Locational Factors affecting the Success of Lessons

Observations of the lessons being conducted from the delivery school and subsequent interviews with staff, indicated that a number of factors resulting from the placement of the equipment impinged upon the successful delivery of the lessons. These consisted of:

1. Distractions

Students constantly experienced distractions during their lessons. This was a result of non synchronised bell times when the primary students emerged from their classes for recess and other out of class sessions. Other distractions occurred on a periodic basis when students were sent to collect resource materials for other classes being held else where in the school. These intrusions were tolerated even though they caused disruptions to the structure and flow of the lessons.

2. Availability of Equipment

There were a number of items that were integral to the Telematics equipment and which were frequently removed from the room by other teachers. For example, from observation, it was noted that the overhead projector was missing, which created the necessity for alternative teaching strategies to be employed by the teacher. The removal of such items by other teachers in the school was a constant source of aggravation for the delivery teachers.

The facsimile machines, which are used to support Telematics lesson deliveries, likewise have been the source of some frustration for all the participants. Lesson notes, homework tasks and work sheets are regularly faxed to and from students at the receiving sites. The facsimile machines, being also used for administrative purposes, were located in the office/administration area which is usually at some distance from the Telematics site. This has necessitated the coordinated distribution of such materials, many of which failed to materialise in time for the lessons. All teachers commented during interview, on the problems created by the lack of immediate access to this equipment.

3. The Time taken for Setting Up and Packing Away.

The supervisors of the primary students at the receiving end, found that the setting and packing up of the Telematics equipment was both time consuming and led to problems with making the required connections. As the Telematics equipment was variously located in each of the smaller schools rather than being set up in an established position, it took a minimum of ten minutes to relocate and set up the links in preparation for each Telematics lesson.

4. Staff Access to the Telematics Equipment

The demands for access to the Telematics equipment for preparation of lessons was seen only as a minor constraint. Most staff felt that there was sufficient in- school time for preparation (an additional allocation of 0.25 for the Telematics classes), and as some teachers used the screens more extensively than others there were few limitations. However one teacher who frequently used a range of visual and graphic screens, would have preferred to complete his preparations other than in school time if the Telematics equipment had been more portable.

5. Student Access to the Telematics Equipment

Students in the receiving primary schools had reasonable access to the equipment usually during their free times and at recess and lunch breaks. It was used by staff and students for a variety of purposes such as word processing, games and in some instances for communicating with other students in other schools.

Assertion 3

The Telematics equipment is 'user friendly', robust, easy to set up and maintain.

Reasons for Choice of Equipment

The notion of a top down model was pre-eminent in decisions that determined the choice of telecommunications equipment. The District Superintendent in 1991, informed schools that they were to embark on a Telematics program in order to provide LOTE classes for their students. Funds were supplied through a Commonwealth Program and administered through the Central Office of the Ministry of Education. Hence decisions were related to system priorities and policies. Other factors that determined the choice of equipment were related to the need for compatibility and connectivity within the system. Consideration for the robustness of the equipment to withstand the extreme climatic conditions that are to be found in Western Australia also formed part of the selection criteria. Previous experiences in other states had showed that the Macintosh machines were capable of operating in all areas regardless of temperature, dust, humidity and other environmental variations. Cost was yet another factor that impinged upon the system's choice, with this type of equipment being relatively cost effective per node and capable of future upgrades or additions such as scanners and other accessories.

Maintenance of Telematics Equipment

There were a number of minor problems directly related to teaching experiences using the Telematics system and included such things as battery replacements, detached speaker wires and the long delays in the replacement of computer parts.

Assertion 4

As teachers become more familiar with the Telematics equipment, additional components become a requirement in order to increase the efficiency and quality of the delivery product.

The Telematics program has been in operation at Wyalkatchem District High School for the past eleven months. During this time staff have become familiar with the equipment and its limitations. At a preliminary meeting and again during interview, most staff reiterated the need for additional funding and resources to further enhance the quality of the lesson deliveries. These were classified as physical resources (e.g. scanners, upgraded software and hardware), human resources (e.g. on-site coordination) and others (such as administrative negotiations for school and examination timetables).

Assertion 5

Technical and human issues, including the capacity to establish and maintain telephone and modem connectivity can be overcome with experience.

Telematics programs rely heavily on the capacity of the system to establish and maintain good telephone connections. Initially technical problems have the potential to overcome any desire to persevere with the equipment, and if the modem and voice connections are constantly denigrated by the quality of the reception, it is unlikely that the system will succeed.

Technical Issues

Frustration with making the appropriate links both for the voice and modem connections has been a feature of the program in the Moora District. Teachers at the delivery sites cited their worst experiences as the infrequent hookups with the receiving schools, and in one case a 'whole week without any connections'. Even when the voice connection had been made, there were times when the level of interference on the line totally negated the outcomes of the lesson.

Other problems relating to the transmission of data were described as the time taken to load and to send the screens. Hands free phones and extension speakers also provided scope for criticism, as these were often unserviceable or working in a reduced capacity that mitigated against the clear reception of the lesson.

Human Issues

The teaching staff reported that the aspects that they found initially the hardest were the absence of body language or eye contact which made it difficult to gauge whether the subject matter was being understood. The maintenance of deadlines, and the requirements to fit within prescribed time frames were also difficulties that had to be overcome. Teachers found that their teaching skills were challenged and the ability to make a single cohesive class that performed in a setting that was socially not conducive to learning, exceptionally difficult. Upon reflecting on their early experiences, the same teachers could cite specific strategies that they had developed to overcome the potentially disastrous circumstances.

Solutions to the Emerging Problems

Communication was seen as the key to survival and the telecommunications medium was used for this purpose. The sharing of problems and seeking solutions has since become a feature of the Moora network. As a result the network is used regularly for these problem solving sessions. Students have also been taught to understand code signals should the network not be functioning efficiently and the teachers increased their availability by giving their home phone numbers to their students to assist with difficulties and any additional queries.

Many of these constraints have been progressively solved by the teachers who have arranged face to face visits and other exchanges for their students during the course of the program.

Assertion 6

The quality of the transmission is critical for Telematics and system level negotiations with the providers of the service are required to enable reliable and unimpeded links.

Both the delivery and the receiving teachers had experienced poor quality reception of both the voice and the modem signal, and in some cases found that transmission was impossible. Investigation on behalf of the schools by the Ministry of Education, revealed that the local Telecom exchanges were inadequate for the designated purposes, namely that of transmitting voice and data at the same time. In some cases there were some initial problems with compatibility of the modems, but while some connections functioned adequately all of the time, others tended to drop out and in one school this was a frequent occurrence.

Telecom is the provider of the service and as such has a responsibility to deliver a reasonable reception. Despite discussions with the schools, little has been achieved in this area. It is therefore the responsibility of the system to arrange with the service provider for a more reliable link.

Assertion 7

Staff training programs, both initial and ongoing are essential for the effective implementation of Telematics, and should cover the development of technical competencies as well as methodologies and resources to support the program.

The on site training for the delivering teachers was seen as experimentation and the technical mastery of the equipment through a trial and error approach. It was considered that there was no training given in the preparation of screens or teaching methodologies to equip beginning Telematics teachers.

The only form of training was considered to be on site training, but the delivery teachers commented that it had stimulated their thinking and had given them the necessary confidence to start with the preparation of screens. On the negative side however, it was seen that this training was not always applicable to the teacher's own subject area.

The staff delivering the Telematics programs had some clear ideas on the type of further training and the type of support that was needed. Additional training in the Macintosh environment, accessing and using the new version of the 'Electronic Classroom', instructional design techniques and related content ideas, public relations and dealing with new innovations from a school base were all deemed important. There were no comments as to where this training and support would originate from, only the desire to further enhance their skills in using the system.

Assertion 8

The introduction of a Telematics program into a district requires adjustments in terms of developing collaborative school networks based on negotiated and agreed administrative arrangements.

The Moora District Network was established in 1992, and as a result of a basic and negotiated agreement between the principals of the participating schools. Since that time other issues have assumed pre-eminence and the success or otherwise of the network was seen by the staff to rest upon a demonstration by the schools' administration to maintenance of their commitment to the program.

The Principal stated that his role was to 'facilitate the project, plan for the acceptance of Telematics as a legitimate mode of delivery, and negotiate the organisational aspects of the district's program.'

The decision to commence teaching using the Telematics system in Moora required considerable negotiations between the participating school administrators in the preceding year. Wyalkatchem is one of the largest district high schools in the Moora district, and in order to meet the needs of the upper school students in the area, discussions with the District Superintendent resulted in the decision to link Wongan Hills with Wyalkatchem District High School. As interest in the program developed, other schools individually approached the Principal of Wyalkatchem to participate in the LOTE program.

Preliminary discussions included negotiations on the organisational structures, the matching of timetables, the identification of staff expertise within all schools in the network, an analysis of enrolment data and subsequent agreement for staffing allocations across the network, viable group sizes, communications mechanisms, resource sharing and the marketing of telematics programs to the school communities.

Identified Resource Problems

One teacher indicated that " there have been ongoing difficulties in the provision of adequate facilities in support of the teaching programs at the receiving site". This was perceived to be due to communication breakdown at the administration level.

Expectations for the Future Use of the Telematics Program

Based on the shortcomings identified earlier, all staff exhibited a reluctance to discuss the future of the program. The dependency on coordinated arrangements meant that their school would become less involved due to the inequitable provision and sharing of resources. The primary schools were eager to contribute and offered some suggestions as to the programs that would be appropriate, although they generally had few extra resources and hence required the support and access to expertise available in the larger district schools. Another teacher perceived the major shortcomings in the system to be the lack of administrative support from one of the receiving schools and that this would be likely to affect future opportunities for future sharing within the network .

Assertion 9

Once implemented, Telematics is seen by the school community as a viable method for providing access to and an extension of the curriculum.

The proposed introduction of the Telematics program into the Moora District initially has had strong support from the teaching staff as well as commitment from those staff not teaching on the program and some minor reservations from the parents. Since its inception, the attitude has been more universally one of general acclaim from all groups. This has been monitored by the schools' principals who stated that their school communities were now totally behind the program especially as it 'responds to the rural inequity claims.'

Perceived Effectiveness of Teaching using the Telematics System

In general this was summed up by most staff who saw the program as a viable second choice, where face to face teaching was not available. In comparison with other distance education courses taught through the correspondence mode, the Telematics option ranked unanimously higher. In two cases, teachers considered that students outcomes would be improved through the Telematics course delivery, especially in such areas as LOTE. Another teacher commented that the learning of a concept was often slower, but the teaching of a syllabus that was factual and graphics based could be effectively guaranteed. However in the main, teachers felt that 'real time' delivery of instruction was preferable, but given the increased motivation of the students, the available teaching expertise and the commitment experienced by all stakeholders, Telematics could provide a valid option.

Opportunities Afforded by Telematics

Access to the program was highly valued as it provided opportunities for widened subject choices. The number of student participants increased once the program was underway, and one teacher stated that 'other students had joined the Telematics class after the first week, and again in the second semester after hearing good reports from other students and parents.'

At the primary schools, the program was identified as providing opportunities for students to start a language program that would then be continued into the high school. Parents themselves have 'sat in' on classes thus providing information to the rest of the community. This has led to the development of a positive image and a high profile for the program in Moora.

The potential for using the system for adult learning has yet to be explored, and the enabling of course offerings either as part of the normal school curriculum or in the form of discrete courses offered in alternative times is a distinct reality in the future.

Parental Support

The introduction of the Telematics program was not entirely smooth and some early negative feedback was experienced by the staff at Wongan Hills. It was discovered however that these comments were based on a series of misconceptions that were later dispelled. Such myths are prevalent in other innovative programs, and issues such as fears of excessive costs, fears that students would be missing out on real teaching and even that Telematics would be just a 'flash in the pan' were part of the early reactions.

Other later documentary evidence supported the claims as to the value of the program. The impact of the Telematics program was such that parents lobbied hard to persuade the Minister and the Ministry of Education to continue the program in 1994 as there was a firm commitment to the perceived values of the program and a sense that the program was to be disbanded.

Assertion 10

Users of Telematics have acquired incidental skills with considerable benefits for teaching and learning.

One of the unintended outcomes of the Telematics program has been the development of other types of skills that are seen as beneficial for both the teachers and the students.

Teaching Skills

The teaching staff, identified a number of extraneous skills that had been acquired as a direct result of the Telematics program. Overall planning skills, including the setting of clear objectives for students, instructional design techniques, alternative teaching methodologies and the creation of new resources were all attributed to the Telematics teaching and learning. The more specific skill development included such areas as oral communication skills, questioning techniques, problem solving skills and the implementation of multiple learning strategies.

Students Skills

One of the stated objectives of the Moora District Telematics Program was to 'develop enhanced independent learning by students, assisted by teachers in a face to face teaching/ facilitator/resource role'. All teachers considered that the acquisition of independent learning skills was evident, with greater

initiative being shown by the students in establishing out of class contact by phone and fax. As one teacher quoted ' Due to the communications workshop and the nature of the Telematics classes, Wongan students have become effective, independent learners. This is evident by the way the students are communicating with their Telematics teachers ... and have approached their study and homework timetable'.

Other skills that have been incidentally acquired as a result of the program were cited as listening skills, general awareness and interpolation skills. The Mathematics teacher stated that the students' organisational skills had developed to a very advanced level as demonstrated by 'the maintenance of files in order, the organisation of special science equipment for lessons and the photocopying of faxed worksheets'. One staff member highlighted the perceived development of language skills in specific areas such as mathematics where the students at the receiving end found it necessary to use appropriate mathematical language to communicate. Another teacher further commented on the noticeable improvement in the articulation and verbalisation skills of the students, and another on the effects of the emerging cohesiveness that was evident in the group tasks where the students worked cooperatively to complete the set tasks.

Assertion 11

In addressing performance outcomes, consideration for the social and psychological needs of the students should also be given high priority.

Despite some initial problems with cohesion, the Telematics teachers have now found that the strategies that were employed to deal with these earlier problems have been effective. In the main the problems related to the psychological adjustments needed by the students, particularly those at the receiving sites.

Source of Problems

1. The perceptions of the students regarding their status in the class and the amount of teacher time that they were receiving mitigated against successful lesson deliveries. One of the teachers experienced some problems in the early stages of the program and suggested a 'them and us' syndrome had been a critical issue for the receiving students . The students at Wongan Hills felt that they were being disadvantaged and neglected by their remote teacher, and that this was reflected in their lower than usual grades.
2. The apparent lack of communication between the two schools resulted in some difficulties for the students and their teachers. As the delivery teacher commented 'we need to be told immediately if there are problems (real or perceived) so that we are not shooting in the dark. We also need frequent feedback on how the students are working and their attitude to the course'.
3. The lack of trust appeared to be an inherent factor in the communications process. The unavailability of body language cues that assist in conveying the more subtle teaching and learning messages, the difficulties experienced in communicating using this particular technology, and the frontier mentality of the participants all contributed to feelings of neglect and concern as to the viability of the medium.
4. Individual students on the receiving sites could dominate the lesson. The classroom dynamics were such that in the early stages the more assertive students were receiving a disproportionate amount of the questions and answers. This was not realised by the teachers until a clear signal was given from a parent who wanted a more equitable approach.

Responses to the Issues

In responding to these problems, the teachers at Wyalkatchem District High School implemented a range of strategies that enabled them to develop relationships of mutual trust. The counselling of students on all sites as to the nature and style of Telematics classes, the inclusion of early face to face visits and the provision of training for the students in both groups were among the recommendations made by the teachers for improving communications. Other strategies included the organisation of a communications workshop, ongoing excursions, school visits and the use of out of hours contact numbers.

The area of social and psychological needs was no intentionally overlooked by the teachers. The attempts to master the technology and to prepare adequately for this form of delivery simply took precedence over other less obvious issues.

One of the teachers felt that 'Telematics has altered the normal classroom dynamics, especially with regard to teacher/student relations. The students at the delivering site have been more sympathetic and receptive to the teachers point of view, and at times quite critical of the students at the receiving end'. This is indicative of the problems that place pressure on a system that has to learn to consider multiple points of view and to develop strategies to overcome the adverse perceptions.

Assertion 12

Telematics teaching requires a discrete methodology that complements normal mainstream teaching and learning.

Classes that are delivered by telematic means, require in addition to the normal classroom practices, a discrete instructional methodology that is inherent in the style of the delivery medium.

Setting Objectives

The historical data in supporting the introduction of the Telematics program in Moora, revealed the following objectives for the program that were developed by the teachers:

1. To provide access to cost-effective teaching of post-compulsory courses while students remain in their familiar environment through resource (personnel time/facilities) sharing.
2. Encourage continuation to post-compulsory studies through providing classroom access to a broader spectrum of subjects.
3. Develop enhanced independent learning by students, assisted by teachers in a face-to- face teaching/facilitator/ resource role.

In addition the Year 11 English teacher added a specific objective relative which was 'To adapt the Year 11 TEE English program to a Telematics delivery within the context of the course requirements'. None of the other delivery teachers, in their report on the Telematics Program (Moora District, Telematics Review 1993), included a specific set of objectives. In the main the adaptation of curriculum materials was implicit in the discussions regarding the following aspects of the Telematics delivery.

Lesson Preparation

Each lesson was governed the determination of the lesson content, the setting of specific objectives and the intended methods for presentation. The preparation of screens often included graphics, text or freehand drawings (diagrams) even though not all of these were used during the lessons. The preparation also extended to the transmission of the prepared graphics and notes via the facsimile to the receiving schools, usually at least two days in advance of the actual lesson. This routine is common practice amongst all the delivery teachers, who through experience have adjusted their schedules to enable time for the coordination, delivery and photocopying of the students' worksheets and other lesson materials.

Preparation time for Telematics lessons varied according to the subject area and the preparations also included the faxing of materials to the receiving schools. In comparison with the preparation time needed for normal face to face teaching, it was generally considered that the preparations for Telematics classes took far longer.

However as one teacher stated, 'It is double the normal preparation time ....but this is because more time is needed initially. This will become less as the screens are saved for future use'.

Lesson Sequencing

In the main, the general sequencing of lessons was planned on a flexible basis to allow for alternative strategies to cope with the instability of the transmission link. The Italian teacher stated that she always plotted the lesson sequence and ' started the lessons with questions related to past work'. Another teacher stated that she rarely loaded text beforehand and that homework was given out by typing a message on the screen at the end of the lesson.

It appears that the communication medium is best suited to using auditory techniques, and as such questions are planned into the lesson sequence and used until such time as the teacher is satisfied that the students have demonstrated that they have internalised the concepts.

The Use of a Variety of Technological Tools

Individual choice and the subject content were the prime determinants of the choice of technological tools. For example the Human Biology teacher used many prepared graphic screens with scanned images, and some freehand diagrams to illustrate his teaching points.

Others teachers made limited use of the screens, preferring to use faxed materials and questions. One teacher claimed that 'it is not always necessary to use the computer screen ... especially if you look on it as the blackboard'. This was particularly true of the Lote classes where the teleconferencing medium using voice alone was considered adequate for the purposes of the lesson.

The mathematics teacher commented that the tools and the software available for teaching upper secondary mathematics were not always suitable, and that other techniques had been employed. 'Writing indices, subscripts and other symbols can be very time consuming in mathematics. Eventually a code system was developed and used (e.g. today a * will mean to the power of two)'.

Teaching Techniques

All teachers made use of questioning techniques, with usually up to about 50% of the lesson being spent on discussion and other oral forms of communication. This took the form of rapid fire question and answer sessions at the start of the lesson, ongoing dialogue in the development of the lesson and further questions at the conclusion of the lesson.

All the delivery teachers commented on the types of questions used for Telematics delivery, which have to be framed carefully in the absence of body language to ascertain the level of the student's comprehension. During the lesson observations, these teachers demonstrated that they frequently used a technique of directing questions to specific individuals. This enabled them to keep records of their responses to ensure that everyone contributed. Individual conversations (via phone not conference hookup) provided all students with close teacher contact – probably more than would happen in a normal classroom.

Good questioning techniques were universally seen as essential with both open ended questions as well as low level short answers being considered appropriate according to circumstance.

Other strategies that the teachers have used, consisted of responding to auditory cues, developing strategies to elicit responses from the students, learning to adjust to slower than normal responses and having a flexible approach to the delivery of the lesson. One teacher also noted that having the Telematics system available, has enabled the modelling of ideal answers as espoused in the developmental language continua.

Classroom Management Skills

All teachers contacted suggested that there were no real disciplinary problems associated with teaching and learning in a distance education setting. The few problems that had arisen, such as a dominant student on the receiving site were handled by the Telematics teacher on a one to one basis by shutting off the conference phone or with assistance from the supervisor/ coordinator at the receiving end. In other cases parents were contacted to ensure their cooperation in the return of homework and assignments. As one teacher commented 'discipline seems to be self imposed'.

Assessment and Reporting

There were no difficulties reported in association with the procedures for assessment and reporting. Students were assessed in several ways including classroom activities, oral participation, assignments (posted/faxed), and tests and examinations given at both sites with an open line for any questions. The only problem that had arisen, was regarding the administrative coordination of the examination timetable for both schools involved in the post-compulsory area.

Reports were issued by the Telematics teachers and sent directly to the various receiving schools who included them in their normal reporting process.

SUMMARY, IMPLICATIONS AND CONCLUSIONS

In general, the experience has shown most teachers that Telematics is a viable method for delivering the curriculum in most content areas. It has provided access to an extended range of subjects for students who are often penalised by the barriers of distance, and a challenge for teachers who are prepared to take on such an innovation even though their own background experiences with computers has been limited.

However, once the initial mastery of a new innovation such as Telematics reached a certain level, the need for further experimentation to produce even better results was universal. Staff now moving into their second year of using this medium, exhibited all the classic signs of wanting to improve the efficiency and the quality of the lessons that they were delivering. This can only be done by upgrading their existing facilities and equipment and the provision of adequate supervisory mechanisms at the receiving sites.

The location of the Telematics equipment in a school is quite significant, and the choice of the location reflected the type and size of the school. At Wyalkatchem, the Telematics equipment was located in a separate room which was used at least part of the time for this purpose. The smaller schools had problems that related to the need to mobilise their equipment for the Telematics lessons, and time was needed to set up and to return the equipment. At the delivery site there was a general lack of awareness by other staff who 'borrowed' essential items that detracted from the full impact of the lesson. Unwanted distractions were also a problem for students and teachers who operated in less than perfect conditions. All of these schools were built for normal/mainstream teaching purposes and the introduction of Telematics has been accommodated to a limited degree, but there still remains some attendant problems.

Despite the seemingly enforced introduction of the Telematics program, it appears that the installation and maintenance of the equipment has not created serious problems. In the main the equipment is sound and was considered appropriate for the delivery of education to distance locations. Of the few problems that have arisen, these have been rectified easily and have not required system level intervention. Staff and students have found the platform easy to use with few difficulties in the setting up either for the delivery or receiving of Telematics lessons.

There are a great many things that can inhibit the effective electronic delivery of instruction. Frustration was experienced by the pioneers of this Telematics program, but the resolution of the technical and the human issues has been seen as a challenge by the teaching staff. In the course of the year, they have adopted a number of measures to overcome such difficulties and have been largely successful in using the same medium for this purpose.

The staff at all schools felt relatively powerless in the face of faulty transmission. The Telematics system requires a guaranteed link, free of interference and the responsibility for this rests with Telecom and their capacity to service country areas. Negotiations at the local level have not resulted in any significant changes, and

it is therefore incumbent on the system to arrange for a more reliable link from the service provider.

The training programs for the Wyalkatchem network appear to have been somewhat ad hoc in their approach. Support from the system, the district office and particularly from the school has been forthcoming, but the needs of the teachers for ongoing training have yet to be met in any consistent way. The initial approach has concentrated on the technical aspects of the training, and any professional development in the area of teaching methodologies has yet to be included as part of the total support for the Telematics program.

The need for collaboration across the teaching network cannot be under-estimated. This is the function and role of the school administrators. In Moora early efforts resulted in the establishment of an effective network which has been somewhat eroded by the unequal commitment on the part of the school administrators despite the best intentions by all staff concerned. The reliance on funding and special grants is not conducive to the longevity of such a project, and alternative sources must be sought with strong local endorsement and support.

Despite some initial opposition, the Telematics program was well received in the Moora District. The effectiveness of the teaching program is ranked highly and above the correspondence mode, but still seen to be less effective that normal face to face teaching. Community support and approval was monitored by the principals and the implementation of the Telematics program seen as a valuable tool in reducing some of the perceived inequities of rural education.

There was evidence from the teaching staff reflecting on their own skill development, and on the significant and observable changes demonstrated by their students, that the Telematics program has had a beneficial effect in other areas. The capacity to work independently was seen as an outstanding feature of the Telematics program, and was supplemented by a range of other skills that were directly attributed to the use of the Telematics system.

The psychological and social issues initially created some areas of concern. In recognising these problems, the teachers developed a series of successful strategies that could well be emulated elsewhere. They included opportunities for regular face to face contact which was valued by both the deliverers and receivers of education.

Telematics has created some changes for teachers in terms of the requirement for different methodologies for the delivery of lessons to students linked through distance learning programs. The setting of clear objectives, extended lesson preparations, and the type and style of presentations required different approaches that were suited to an electronic format. All of the teachers relied heavily on good questioning techniques with additional interest being generated through the presentation of screens designed to assist in the development of concepts. Discipline was not seen as a barrier to this form of learning, and the students were sufficiently motivated to eliminate any serious concerns. Assessment and reporting techniques were in the main based on the normal methods for assessing student performance.

It was found that overall the program was very successful in providing access for students who resided in rural areas in Western Australia. However this study has raised some serious concerns about the future of the Telematics program in a district such as Moora. The two most important issues revolve around the support for the staff which is a reflection of the commitment by the Ministry of Education and the provision of a better and more reliable service through Telecom. All participants in the program have appreciated the benefits that a program of this nature can bring to a rural area, and these benefits are perceived to outweigh the negative perceptions that have in the past been associated with the introduction of technology to schools throughout Australia.

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